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(54) Tightening screw

Spannmutter

Vis de serrage

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Description

The invention relates to a tightening screw to be used as a tightening screw (for example, a nut) for tightening a rotary tool such as wheel of hand grinder and circular saw or hand saw to a mounting threaded part (for example, male threading) spirally provided in a drive shaft, being capable of tightening powerfully with a small rotary input and loosening, and regulating excessive tightening.

To mount a rotary tool such as grinding wheel and circular saw on a driving shaft, hitherto, a flange and male threads were formed at the end portion of the driving shaft, and the rotary tool was fitted to the male thread part, and a tightening screw with female threads such as a nut was fitted on its outer part, and by tightening the nut, the rotary tool between the nut and the flange was fixed.

In tightening and loosening operation of such nut, however, a power tool such as wrench was generally used, and therefore a sufficient amplification may not be obtained because only this power tool is used for amplifying the force to tighten or loosen the nut.

Besides, in the use of such rotary tool, if the rotary tool is used with an impact, the nut may be tightened more than desired by the impact and its reaction, and the nut is too tight when replacing the rotary tool, and it may not be removed by such power tool as wrench, and the nut cannot be removed unless the rotary tool is broken in an extreme case.

A tightening assembly according to the preamble of claim 1 is known, for example, from WO-A-88/05386.

A tightening screw in which a rotating ring is rotatably held on a flange ring, a screw member having female threads in the same pitch as the male threads of the bolt to be fitted, with the female thread diameter formed larger than the male thread diameter, is rotatably held eccentrically so that some of female threads of the screw member may be engaged with the male threads preliminarily, and the flange is fixed at the time of tightening so that the rotating ring may revolve the screw member, and thereby the decelerated rotation created in the screw member produces a large tightening force to increase the torque.

It is a first object of the invention to present a tightening screw capable of obtaining a large tightening force or loosening force with a small rotary input, mounting the object securely, tightening or loosening directly by hand, without using power tool, because of the generation of a powerful rotational force increased in torque, and enhancing the attaching and detaching manipulation of the tightening screw.

It is a second object of the invention to present a tightening screw capable of attaching and detaching the tightening screw quickly without taking time in attaching and detaching because the rotary motion of the rotating ring or operating ring is directly the rotary motion of the screw member until the flange ring of the tightening screw abuts against the object to be tightened to fix the rotary motion.

It is a third object of the invention to present a tightening screw capable of preventing excessive tightening of the tightening screw during rotating job of the object to be tightened, by interspacing a flange ring for keeping a relative rotary motion between the revolving ring and the object to be tightened, so that the revolving ring may not rotate together with the object to be tightened.

It is a fourth object of the invention to present a tightening screw capable of distributing uniformly the uneven loads of screw members, rotating the tightening screw smoothly, and tightening with an effective increased torque, by disposing plural screw members uniformly on the circumference around the bolt to be tightened.

The invention is defined in claim 1.

In the accompanying drawings:

Fig. 1 is a sectional view of a tightening screw.

Fig. 2 is an exploded sectional view of the tightening screw.

Fig. 3 is an explanatory diagram showing an eccentric state of a nut ring.

An embodiment of the invention is described in detail below by reference to accompanying drawings.

The drawings show a tightening screw, and in Fig. 1 and Fig. 2, the tightening screw 10 is composed of a flange ring 11, a rotating ring 12, screw members of a first nut ring 13 and a second nut ring 14, and an operating ring, and in each central part of the flange ring 11, rotating ring 12 and operating ring 15, for example, insertion holes 18, 19, 20 are formed for inserting mounting bolts 17 of a drive shaft 16 of a power tool such as hand grinder. A flange 21 is formed on the drive shaft 16, and a rotary tool 22 to be tightened, for example, a wheel of a hand grinder is tightened and fixed between the flange 21 and the tightening screw 10 on the mounting bolt 17.

The rotating ring 12 is rotatably held in the flange ring 11 through a bearing 23, and the nut rings 13, 14 are rotatably held in the rotating ring 12 through bearings 24, 25, respectively, and the rotating ring 12 is press-fitted into the operating ring 15, and fixed in one body. On the outer periphery of the operating ring 15, a knurling 15a for rotating is formed. Numeral 26 is an O-ring for sealing the gap.

Female threads 27, 28 cut in the nut rings 13, 14 are formed in the same pitch as the male threads 29 of the mounting bolts 17, and the screw diameter of the female threads 27, 28 is greater than that of the male threads 29, and the nut rings 13, 14 are held in the rotating ring 12 by eccentricity so that each part of the female threads 27, 28 may be engaged with the male threads 29 of the mounting bolts 17. The relative eccentric positions of the first nut ring 13 and second nut ring 14 are spaced at an interval of 180 degrees so as to be equally distributed on the circumference of the center 29a of the mounting bolt 17 (male threads 29) as shown

in Fig. 3. Meanwhile, Fig. 3 shows the effective diameters of the female threads 27, 28 and male threads 29, and 27a is the center of the female threads 27, 28a is the center of the female threads 28, and these centers 27a, 28a are remote from the center 29a of the male threads 29 by 180 degrees.

By using thus composed tightening screw 10, in order to mount the rotary tool 22 on the mounting bolts 17 of the drive shaft 16, the operating ring 15 of the tightening screw 10 is directly rotated by manual operation on the male threads 29 of the mounting bolts 17, and the female threads 27, 28 of the both nut rings 13, 14 are screwed in, and in this screwing operation, if the flange ring 11 does not contact with the rotary tool 22, the operating ring 15, flange ring 11, rotating ring 12, and both nuts 13, 14 are rotated together by the assembling load, and the tightening screw 10 is fed forward in threads by the engagement between the contact parts of the female threads 27, 28 of the both nut rings 13, 14 and the male threads 29 of the mounting bolt 17.

Successively, when the flange ring 11 abuts against the rotary tool 22, and its rotation is loaded to stop the rotation of the flange ring 11 by this load, the rotary input applied to the rotating ring 12 through the operating ring 15 is applied to both nut rings 13, 14, thereby putting these nut rings 13, 14 into rotation, and the nut rings 13, 14 make rolling motions so that the female threads 27, 28 roll on the periphery of the male threads 29 of the mounting bolt 17, while the nuts 13, 14 revolves by the rolling motion as the female threads 27, 28 are longer than the male threads 29 in peripheral length, and this revolution means slowdown of the screw pitch feed of the rotating ring 12, and therefore the torque increases in the nut rings 13, 14, and by the revolution of the increased torque, the nut rings 13, 14 are screwed to the mounting bolts 17, so that the rotary tool 22 may be tightened and fixed to the mounting bolt 17 with the tightening force of the increased torque.

Incidentally, when the two nut rings 13, 14 are uniformly disposed as shown above, the bias load with increased torque of the nut rings 13, 14 uniformly acts on the periphery of the mounting bolt 17, so that smooth tightening may be achieved.

The torque increase rate of the nut rings 13, 14 is greater as the screw diameter having the greater diameter of the female threads 27, 28 approaches the screw diameter of the male threads 29 having the smaller diameter of the mounting bolt 17, and becomes smaller as going apart. In other words, the torque increase rate is higher as the peripheral length of the female threads 27, 28 is closer to the peripheral length of the male threads 29.

When loosening the tightening screw, since the rotation is already blocked as the flange ring 11 hits against the object such as the rotary tool 22, the nut rings 13, 14 are in rotating state, and as the rotary operation of the rotating ring 12 in the loosening direction revolves the nut rings 13, 14, the nut rings 13, 14 are rotated in the loosening direction with the same increased torque force as above.

Consequently, as the nut rings 13, 14 are loosened, and the flange ring 11 is departed from the object such as the rotary too until this rotation is permitted, the entire tightening screw 10 rotates in one body, and the rotation of the rotating ring 12 becomes the rotation of the nut rings 13, 14, so that loosening may be quickened.

In this embodiment, two nut rings 13, 14 are used, but it is possible to composed by using only one, or three or more, and when composing of a plurality of nut rings, it is desired to distribute the engaging positions with the bolts to be tightened uniformly so as to apply uniform loads to the bolts to be tightened. In the embodiment, meanwhile, the tightening screw 10 is rotated by hand, but a wrench or other power tool may be also used. In this case, it is possible to tighten with a less effort.

Claims

1. A torque enhancing tightening assembly for clamping a tool (22) on a rotatable shaft (16) having a threaded portion with a male thread, said tightening assembly comprising:

   a flange ring (11) having a central hole (18),
   characterised by a rotary ring (12) which is rotatable relative to said flange ring (11) and is provided with an inner hole (19) and in which a screw member (13, 14) is rotatably and eccentrically held, said screw member (13, 14) being provided with a female thread (27, 28) of the same pitch as and greater diameter than the male thread (29) of the shaft (16), so that only part of the female thread of the screw member can be engaged with the male thread.

2. The tightening assembly as claimed in claim 1, wherein a plurality of screw members (13, 14) are disposed uniformly on the circumference of the threaded portion of the shaft (16).

3. The tightening assembly as claimed in claim 2 wherein the screw members (13, 14) are axially adjacent to one another.

4. The tightening assembly of any preceding claim wherein the or each screw member (13, 14) is held in an eccentric circular recess in the rotary ring (12).

5. The tightening assembly of any preceding claim wherein the flange ring (11) is disposed adjacent an axial end of the screw member or members (13, 14).

6. The tightening assembly of any preceding claim including a bearing (23, 24, 25) disposed between

the flange ring (11) and the or each screw member.

Patentansprüche

1. Spannmutter mit Kraftverstärkung für das Einspannen eines Werkzeuges (22) an einer rotierenden Spindel (16), mit einem Außengewinde, wobei die Spannmutter einen Flanschring (11) mit einer zentralen Bohrung (18) aufweist, **gekennzeichnet durch** einen drehbaren Ring (12), welcher gegenüber dem Flanschring (11) drehbar und mit einer inneren Bohrung (19) versehen ist, in welchem ein Schraubglied (13; 14) drehbar und exzentrisch gelagert ist, das mit einem Innengewinde (27; 28) ausgestattet ist, das die gleiche Gewindesteigung, jedoch einen größeren Durchmesser als das Außengewinde (29) der Spindel (16) aufweist, so daß nur ein Teil des Innengewindes (27; 28) des Schraubgliedes (13; 14) im Eingriff mit dem Außengewinde der Spindel (16) kommen kann.

2. Spannmutter nach Anspruch 1, bei welcher eine Mehrzahl von Schraubgliedern (13; 14) gleichförmig über den Umfang des Gewindeabschnittes der Spindel (16) verteilt angeordnet sind.

3. Spannmutter nach Anspruch 2, bei welcher die Schraubglieder (13; 14) axial nebeneinander angeordnet sind.

4. Spannmutter nach einem der vorangegangenen Ansprüche, bei welcher das oder jedes der Schraubglieder (13; 14) in einer exzentrischen runden Ausnehmung des drehbaren Ringes (12) gelagert ist.

5. Spannmutter nach einem der vorangegangenen Ansprüche, bei welcher der Flanschring (11) gegenüber der Stirnseite des Schraubgliedes oder der Schraubglieder (13; 14) angeordnet ist.

6. Spannmutter nach einem der vorangegangenen Ansprüche, bei welcher ein Kugellager (23; 24; 25) zwischen dem Flanschring und dem oder jedem der Schraubglieder (13; 14) angeordnet ist.

Revendications

1. Vis de serrage avec amplification de puissance pour le serrage d'un outil (22) à une broche rotative (16) comportant un filetage extérieur, la vis de serrage comprenant un collier (11) pourvu d'un alésage central (18), caractérisée par un anneau (12) mobile sur un axe et orientable par rapport au collier (11) et pourvu d'un alésage intérieur (19) dans lequel est logé de façon rotative et excentrique un élément à vis (13; 14) qui est pourvu d'un filetage intérieur (27; 28) présentant le même pas de vis mais un diamètre plus grand que le filetage extérieur (29) de la broche (16) de manière à ce que seulement une partie du filetage intérieur (27; 28) de l'élément à vis (13; 14) peut venir en prise avec le filetage extérieur de la broche (16).

2. Vis de serrage selon la revendication 1 dans laquelle une pluralité d'éléments à vis (13; 14) est disposée régulièrement au pourtour de la section filetée de la broche (16).

3. Vis de serrage selon la revendication 2 dans laquelle les éléments à vis (13; 14) sont disposés de façon axiale l'un à côté de l'autre.

4. Vis de serrage selon l'une des revendications précédentes dans laquelle l'élément à vis respectivement chacun des éléments à vis (13; 14) est logé dans un creux rond excentrique de l'anneau (12) mobile.

5. Vis de serrage selon l'une des revendications précédentes dans laquelle le collier (11) est disposé en face du côté frontal de l'élément à vis respectivement des éléments à vis (13; 14).

6. Vis de serrage selon l'une des revendications précédentes dans laquelle un roulement à billes (23; 24; 25) est disposé entre le collier et l'élément à vis respectivement chacun des éléments à vis (13; 14).

FIG.1

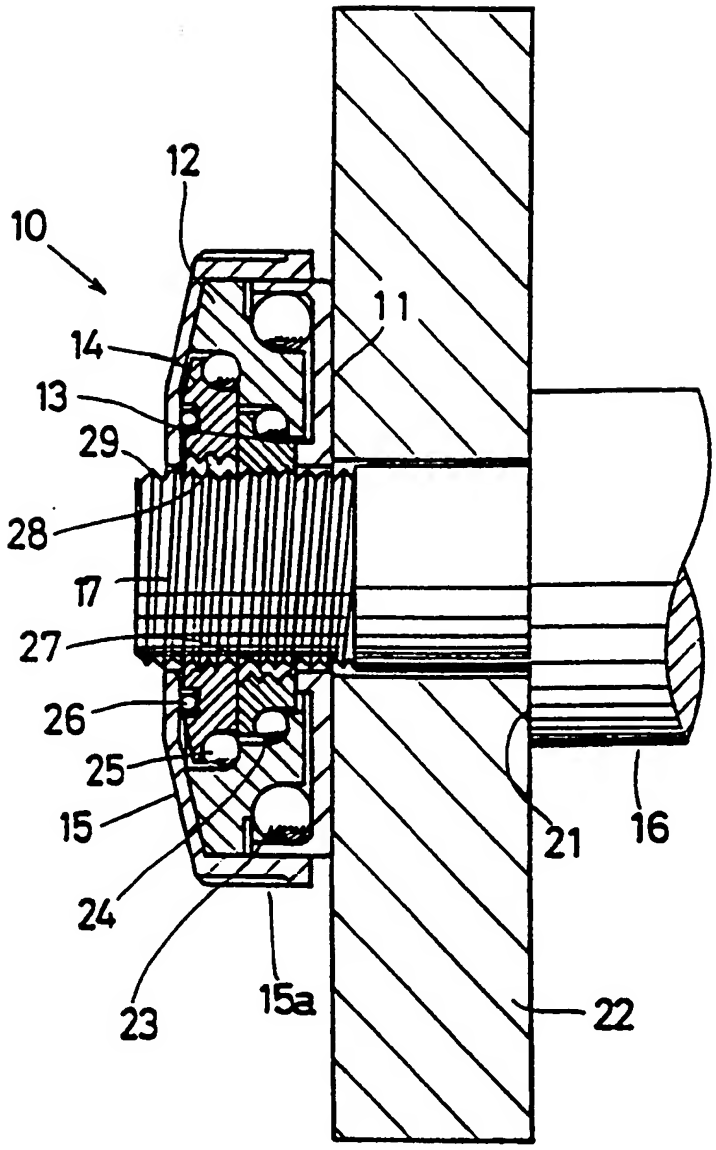

FIG.2

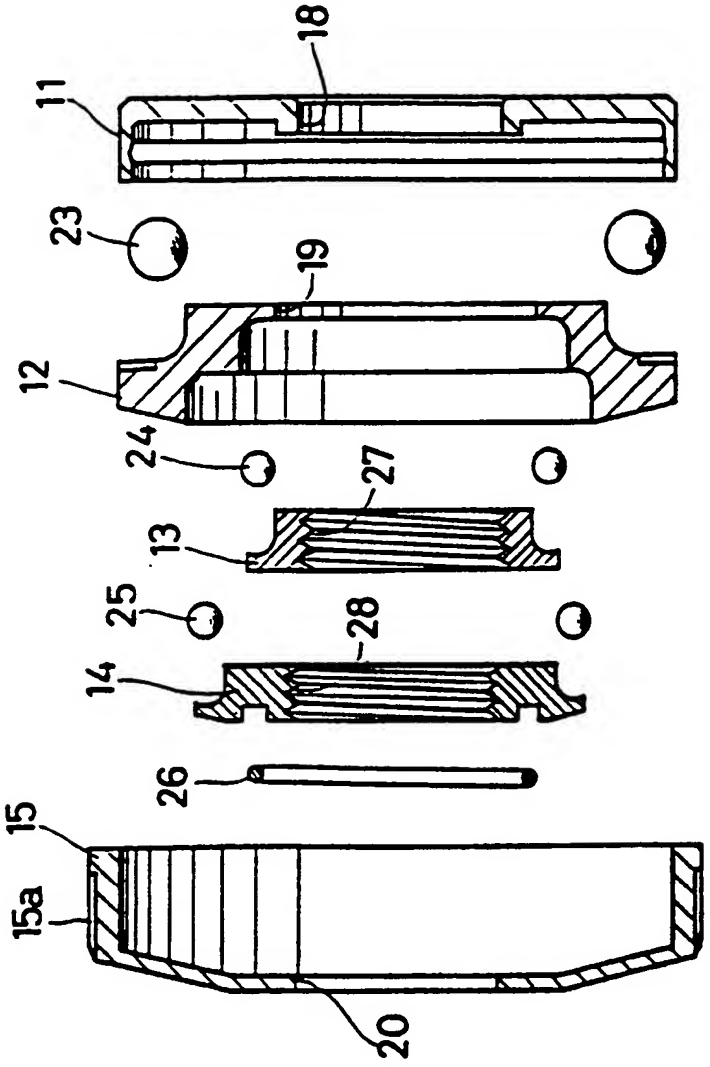

FIG. 3